DG & CHP Technologies
an overview;
Microturbines

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An update since Boston……

Microturbine Players

Current Product Offerings

Bowman POWER The New Wave In Energy – 80 *and 100* kW CHP: CG ; RG; SG

Capstone – 30 and 60 kW Elec.; CHP (option)

ELLIOTT ENERGY SYSTEMS – 80 kW Elec. *and CHP(Q4 03)*

Ingersoll Rand – 70 kW CHP*

Turbec – 100 kW CHP *(not in Americas)*

* Using low speed alternator technology

Microturbine Players

Estimated Shipped Volumes

Bowman POWER The New Wave In Energy – circa 100

Capstone – circa 2500

ELLIOTT ENERGY SYSTEMS – circa 200

Ingersoll Rand – circa 80

Turbec – circa 150

Issues facing Microturbines

- Technology
  - Design Life Still to be Proven (End Users still perceive risk)
    - Leasing, Extended Warranties, Long Term Support, ESCo sales
- Regulatory
  - Exit Fees/ Departing Load
  - Standby Charges
  - Interconnection issues
  - Politics of Energy
- Economic
  - “Spark Gap”
    - Region Sensitive

Bowman Performance

- Operating hours

Cumulative

Ingersoll Rand

Capstone

ELLIOTT ENERGY SYSTEMS

Turbec

Bowman POWER The New Wave In Energy

over 5 million hours

Bowman Performance

- Operating hours continuous

Capstone

> 37k hours

Turbec

> 18k hours

Bowman POWER The New Wave In Energy

> 11k hours

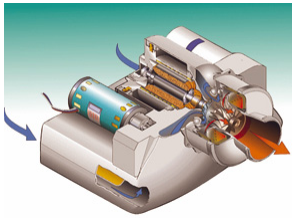
And counting……

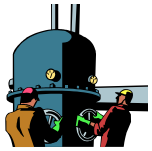
Current Market Status

- Volumes in field
  - Actual numbers smaller than hoped but growing
  - Lowered/Realistic expectations for 2003
  - Focus is leading to good results
  - Industry is going through some re-alignment

Electrical Efficiency Alone Not Adequate for Most Applications

MTG 25-30%



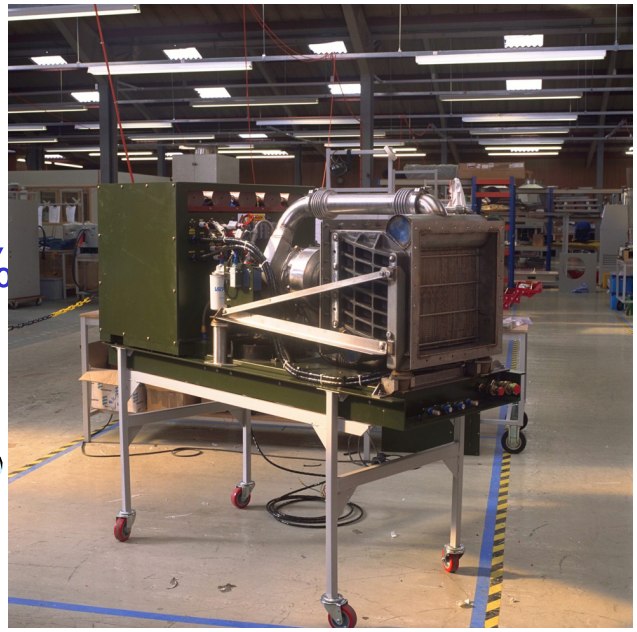


Heating

However, niche opportunities do exist

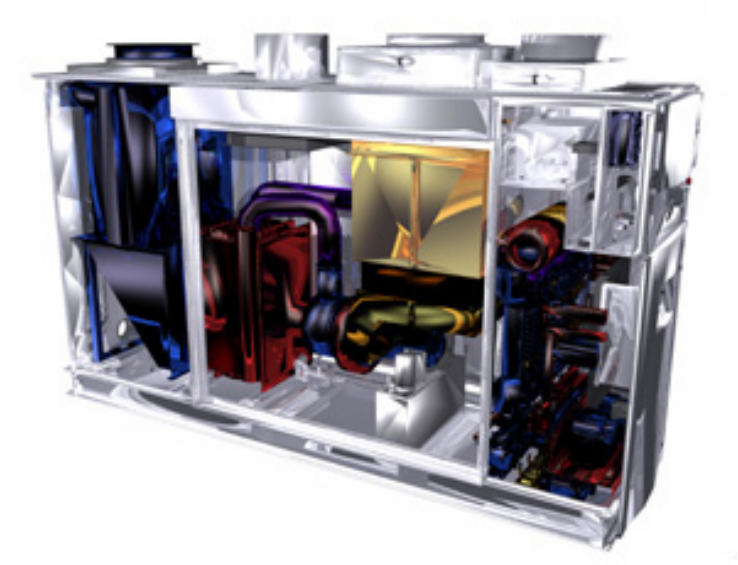
or 45-55%

Cooling



Thermal Applications

- What would it be used for?



- Primary - Offset daily costs for electricity and natural gas
  - –Baseload operation (electrical)
  - –Avoid use of alternate hot water sources (thermal)
- Secondary - Provide backup to critical systems in the event of a rolling blackout

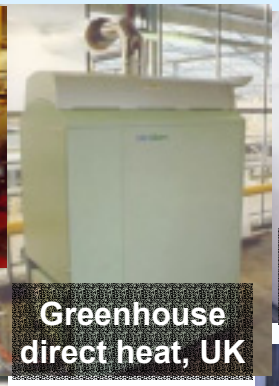
Installation - Heating, Chilling, & Electricity

Hundreds of MicroCHP Sites Worldwide


Meidensha-Sumitomo OEM CHP unit at a


96% eff. public pool CHP, Neth.


City hall heating, UK


Greenhouse direct heat, UK

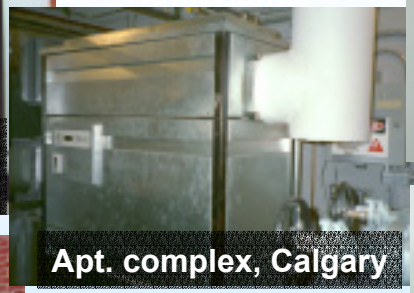

OEM CHP 8-pack at a hospital in Japan


Brick drying,


6-pack of C30s preheats inlet water to boilers at California State University Northridge, CA


Nursing home, NY

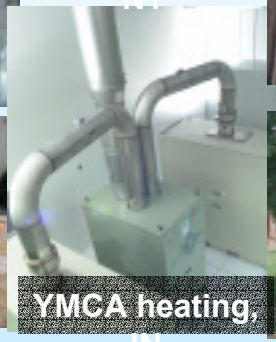
City hall heating, CA


Apt. complex, Calgary


Building heating, Brazil


San Diego Navy base


Reliant LNG Storage, MN


YMCA heating, IN


Nursing home, IA

Microturbine Advantages

Microturbine		Recip Engine
40,000 hrs	Design Life	2,500 hrs until rebuild
1.0-1.3 ¢ per kW/hr	Maint. Costs	1.5 – 4 ¢ per kW/hr
70 dBA @ 1 yard	Noise	80-100 dBA @ 1 yard
<18ppm NOx	Lower Emissions	>50ppm
	Higher heat rates	

Microturbine Advantages

Microturbine vs. Grid/Utility Supply

Higher efficiency

High Power Quality

Reliability

Security of Supply

FEMP Applications

- Potential Applications
  - Building/office Complexes
  - Institutional (schools/prisons)
    - Catering, heating, laundry, AC
  - Power Quality
  - Power Security/reliability
  - Others……

Capital

FUNDS STILL AVAILABLE!

- California Power Authority Initiative
- AB970- rebate incentive for CHP
- PULSE Program

NYSERDA

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

FUNDING OPPORTUNITIES

Outlook for Microturbines

Conclusion:

In the right application a microturbine based system makes compelling economics and will contribute to the DER mix of technologies.

Thank you

More Information or Questions Contact:

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